NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WASTE TREATMENT

(Each)

CODE 629

DEFINITION

The mechanical, chemical or biological treatment of agricultural waste.

PURPOSE

To use mechanical, chemical, or biological treatment facilities and/processes as part of an agricultural waste management system:

- To improve ground and surface water quality by reducing the nutrient content, organic strength, and/or pathogen levels of agricultural waste.
- To improve air quality by reducing odors and gaseous emissions
- To produce value added byproducts
- To facilitate desirable waste handling, storage, or land application alternatives.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where the form and characteristics of agricultural waste make it difficult to manage so as to prevent it from becoming a nuisance or hazard or where changing the form or composition provides additional utilization alternatives, and where conventional waste management alternatives are deemed ineffective. More specifically:

- Liquids and solids need to be separated for further processing or for effective transport and subsequent utilization.
- Raw agricultural waste contains excess nutrients for land application based on crop utilization requirements or nutrient ratios need to be modified to be more consistent with crop utilization requirements.
- There is a need to reduce the potential for leaching or runoff of nutrients.
- Odors and/or gaseous emissions from livestock production facilities and waste storage/treatment system components must be reduced.
- Value-added byproducts can be produced to offset treatment costs.
- Reduction of pathogens is required.

CRITERIA

General Criteria Applicable to All Waste Treatment Purposes

Laws and Regulations. Waste treatment facilities and processes must be planned, designed, and constructed to meet all federal, state, and local laws and regulations.

This practice may adversely affect cultural resources. Planning, installation and maintenance must comply with GM 420, Part 401, *Cultural Resources (Archeological and Historic Properties)*.

Design. The system provider shall complete and supply to the land owner/operator a detailed design of the facility/process clearly outlining the objectives and anticipated outcomes of implementation.

The design documentation shall include a process diagram containing, at a minimum, the following information:

1. Volumetric flow rates including influent, effluent, and recycle streams.

2. Waste load projections including volume, mass, and characteristics of the waste important to the waste treatment facility or process.
3. Unit process volumes and hydraulic retention times where appropriate.
4. Air emissions projections from the system.
5. Nutrient fate projections within the system.
6. Process monitoring and control system requirements as described below in the Monitoring section of the criteria.

Independent, verifiable data demonstrating results of the use of the facility or process in other similar situations and locations shall be provided.

Where use of a waste treatment facility or process to improve one resource concern negatively impacts another, impacts and mitigation measures, if required by state or local agencies, are to be documented. The mitigation measures shall become a required component of this practice.

Plans and Specifications to document this practice shall be as described below.

Components. Waste treatment facilities and processes may consist of multiple components. Where criteria for individual components are described in existing NRCS practice standards, those practice standards and their specific criteria shall be used for planning, designing, and installation of that component.

Where components of a facility or process are not described in a current NRCS practice standard, the system provider shall furnish a one year warranty on all construction or applied processes. In addition, the manufacturer shall provide a warranty that describes the service life of each component and what the warranty covers.

The waste treatment facility or process shall have a minimum practice life of ten years. Where components have less than a ten year service life, their planned replacement during the life of the practice shall be clearly identified in the Operation and Maintenance Plan.

All precast concrete materials shall be constructed in accordance to ASTM C913 – "Precast Concrete Water and Wastewater Structures. All other materials shall conform to the applicable ASTM specifications. Components shall be suitable for the site conditions. These conditions include vehicular traffic and soils loads, corrosion of materials, floatation of tanks, and frost action.

Expected System Performance. The expected system performance shall be clearly documented prior to system installation. At a minimum, the expected system volumetric flow rate, expected macro-nutrient reductions or change in form, expected pathogen reductions, gaseous ammonia and hydrogen sulfide emissions reductions (or increases) shall be documented.

Operating Costs. Where components of a facility or process are not described in a current NRCS Conservation Practice Standard, the system provider shall furnish an annual estimate of operating costs for the system. Operating costs not based on actual systems data shall be clearly identified as estimates.

Monitoring. Equipment needed to properly monitor and control the waste treatment facility or process shall be installed as part of the system. Process control parameters to be monitored shall include those parameters identified in the design documentation. Parameters considered critical to proper system operation shall be identified in the Operation and Maintenance Plan. Run status of critical equipment and unit processes shall be monitored.

Byproducts. Implementation of a waste treatment process or operation of a waste treatment facility shall not result in discharge of byproducts harmful to the environment.

All byproducts shall be handled and stored in such a manner as to prevent nuisances to neighbors or to the public at large.

Byproducts land applied to supply plant nutrients shall meet the criteria in NRCS Conservation Practice Standard 633, Waste Utilization and NRCS Conservation Practice Standard 590, Nutrient Management.

Any unmarketable or unused byproducts shall be handled and disposed of in accordance with all applicable federal, state, and local laws and regulations. A plan for dealing with such byproducts shall be prepared and approved by NRCS prior to utilization of the process or installation of the waste treatment facility, and shall include a listing of any permits or permissions required for the execution of the plan.

Byproducts shall be recycled to the extent possible without causing a hazard to the environment.

Safety. Design of the process or facility shall include safety features to minimize hazards. Guards and shields shall be provided for moving parts of the equipment used in the treatment process. Waste treatment facilities shall be fenced and warning signs shall be posted where needed to prevent children and others from entering a hazardous area.

All treatment processes shall be carried out in accordance with all safety regulations. Protective clothing shall be utilized when handling potentially harmful chemicals that may be used in the process. Proper ventilation shall be provided.

Criteria Applicable to Milkhouse Wastewater Infiltration Areas

This practice is intended for milkhouse wastewater from small dairy operations where the anticipated flow is ≤ 350 gallons per day. Manure from the animals shall be excluded from the system. This practice does not apply when it is practical and reasonable to add the wastewater to the waste storage facility.

This practice shall be located and designed using procedure shown in the Agricultural Waste Management Field Handbook (AWMFH), Chapter 10, Section 651.1004(k), Amendment VT-1, “Milkhouse Wastewater Infiltration Area”.

Air Trap. An air trap shall be installed in the distribution pipeline. The purpose is to prevent gases from entering the milking center.

Air Vent. Air vents shall be installed where needed to maintain atmospheric pressure in the system. Odors may be prevalent from air vents.

Pipeline. For gravity systems the pipeline shall be PVC pipe shall be used a minimum inside diameter of 4 inches. Minimum slope for gravity pipelines shall be 1 percent. Pipe for pump systems shall meet the pump manufacturer’s specifications for size and pressure rating. Clean out access to the pipe line shall be provided at every deflection greater than 45 degrees, high points, and low points in the profile and at intervals not exceeding 100 feet. Pipe shall be located at an adequate depth or otherwise protected to avoid damage from vehicles and frost.

Settling Tank. A settling tank shall be used to trap heavy solids.

A grease trap shall be used to remove milk fats, grease, and other floatable solids.

The combined capacity of the solid and grease traps shall be a minimum of six (6) times the actual daily flow. The settling tank and grease trap shall be water tight, designed not to float and be accessible year-round for periodic clean out. Clean out ports shall have risers and covers for accessibility and safety.

Effluent filter. A minimum of one effluent filter shall be installed at the outlet end of the grease trap. The maximum size opening of the filter shall be 1/32 inches and shall be designed to handle the anticipated flow rate. This filter shall be removable for periodic cleaning and maintenance.

Pump. If necessary a pump station shall be installed to transfer wastewater from the wastewater source to the settling basin. The settling basin and grease trap shall be located to provide gravity feed to the disposal field. Pumping wastewater directly to the disposal field will not be allowed. This standard does not address or provide criteria for pressurize disposal fields. A standard sanitary pumping station is recommended. The pump station shall have a riser and cover for year-round accessibility and safety. The pump shall be solids handling type sewage pump designed to handle the anticipated flow rate and hydraulic head.

Distribution Box. A distribution box shall be used to distribute the effluent evenly throughout the disposal field. In a single linear terraced disposal fields, the distribution box is not needed, but encouraged to allow access to pipes.

Disposal Field. A site investigation is required to locate the disposal field. The disposal field should be located as far as practical from water sources, property lines, and other resource concerns. See AWMFH, Amendment VT-1, Table 1 for minimum isolation distances from any edge of the disposal field.

A soil investigation, with at least one soil observation describing the representative soil profile, is needed to size and locate the disposal field. Select the soil profile shown in Table 2 of the AWMFH, Amendment VT-1, which best describes the soil on site to design the system. If possible a soil scientist should conduct this investigation.

Soils that are in Design Class 2 or 3 as defined in Table 3 of the AWMFH, Amendment VT-1, must be modified to protect the groundwater.

Exclude all surface and subsurface water from the disposal field.

Fence. Fence around the disposal field as necessary to exclude equipment and animals.

Criteria Applicable to Collection, Handling and Treatment of Silage Leachate

This practice shall be designed and installed to collected, handle, store and treat leachate and rainfall runoff from bunker or trench silos, conventional tower silos and plastic bag silos.

Location. To minimize the potential for contamination of streams, silage leachate collection and transfer facilities should be located outside of the floodplain. However, if site restrictions require location within the floodplain, they shall be protected from inundation and damage from a 25-year flood event. This facility shall be located so that prevailing winds and landscape elements such as building arrangement, landform, and vegetation minimize odor and protect aesthetic values.

Collection System. The collection system shall be designed and installed to separate concentrated leachate from the rainfall runoff. The system shall be designed to convey the runoff from a two year – one hour storm event. Components must include:

1. A screen system to trap solids out of the runoff,
2. A settling area up gradient of the screen(s) that allow solids to settle out and be collected, and
3. A flow splitting device that separates high flow rainfall runoff from low flow leachate.

The collection system may also include, but is not limited to, a drop inlet, concrete pad, curbing, gravel filled trenches, collection tanks, and pumps.

Collection and Transfer of Concentrated Leachate (Low Flow). Whenever possible, concentrated leachate (low flow) shall be collected and diverted to a waste storage facility. When direct transfer to a waste storage is not possible, the leachate shall be collected and temporarily stored. This storage shall be periodically emptied and transported to a storage facility or land-applied according to the nutrient management plan. Gravity transfer pipes shall be non-corrosive with a minimum diameter of 4 inches; pumps and their components shall be designed to withstand the corrosiveness of silage leachate and shall be sized for the minimum run and rest times of the pump, per manufacturer's recommendations.

Collection of concentrated leachate or low flow will occur throughout the year and collection tanks will need to be emptied on an ongoing basis. Tile drains beneath or around bunks will need to be evaluated to determined if they are to be treated as rainfall runoff or concentrated flow.

Collection and Treatment of Rainfall Runoff (High Flow). Every bunk silo site shall be evaluated to determine if the rainfall runoff from the silo is discharging into a water body or course or causing other adverse environmental impacts. This evaluation should be conducted in cooperation with the Vermont Agency of Agriculture, Agency of Natural Resources or other regulatory agency. If the site evaluation determines that the high flow runoff from the bunk silo poses a potential water quality problem, then the runoff from the bunk silo must either be treated or stored.

If water quality objectives can be met with vegetative treatment, the runoff shall be transferred to a settling basin. The basin shall be large enough to completely store the runoff from a 25 year – 24 hour storm event from the contributing area. A minimum of 0.5 feet of

freeboard shall be added to the top. The principal spillway of the settling basin shall be design to release the effluent at a rate to meet the required drain time in Table 1. A longer release rate from the settling basin can allow the treatment area to be constructed smaller. The vegetated area shall be sized as follows:

Table 1 - Ratio of VTA Area vs. Drainage Area

Basin Drain Time (Hours)	Soil Infiltration Rate (Inches/Hour)		
	<0.2	0.2 to 0.6	>0.6
30	1.4	0.5	0.3
48	0.9	0.3	0.2
72	0.6	0.2	.01

Ref. Page 6-10 (Table 6-3) – "Vegetative Treatment Systems for Open Lot Runoff – A Collaborative Report", June 2006.

The discharge end of the treatment area shall be no closer than 100 feet from a water course. The effluent shall be discharged onto the treatment area from the settling basin in sheet flow. A distribution mechanism such as a stone berm shall be installed perpendicular to flow at least every 50 feet along to the total length.

If water quality objectives cannot be met with vegetative treatment, the runoff shall be transferred to a waste storage facility that is properly sized to store the runoff from production area for a minimum of 180 days. If the waste storage facility is sized and designed only for the storage of bunk silo runoff, the effluent can be irrigated onto nearby crop fields provided that the system does not exceed the water holding capacity of the soil and the nutrient needs of the crops.

Other treatment methods or alternatives maybe considered if approved by VT Agency of Agriculture.

Safety. Warning signs, fences, bars, rails, and other devices shall be provided, as appropriate, to ensure the safety of humans and livestock.

CONSIDERATIONS

Location. The waste treatment facility should be located as near the source of manure or other waste as practicable and as far from neighboring dwellings or public areas as possible. Proper location should also consider slope, distance of manure and other waste transmission, vehicle access, wind direction, proximity of streams and flood plains, and visibility.

In determining the location of the facility, consider elevation and distance from various components to take advantage of gravity flow where possible.

Manure Characteristics. Waste treatment may require specific total solids and nutrient contents of the waste stream. Pretreatment options such as dilution or settling could be used to adjust the solids content before entering the waste treatment facility or process.

Visual Screening. The visual impact of the waste treatment facility or process should be evaluated within the overall landscape context. Screening with vegetative plantings, landforms, or other measures may be implemented to alleviate a negative impact or enhance the view.

Milkhouse Wastewater Infiltration Area. Whenever possible, the first flush, when washing the milking system, should be diverted away from the infiltration system and used to feed the livestock.

Silage Leachate. Prior to design of a leachate collection and storage system, ground water and bedrock conditions at the silo must be evaluated. If high groundwater or seepage conditions exist, it may be necessary to install a subsurface drain. Surface water shall be diverted away from the bunk or trench silo. If efforts to manage existing water conditions and bedrock prove impractical, consider moving the silo to a more suitable location.

Cover open silage piles with UV resistant airtight 6 mil plastic or equivalent. Coverings need to be weighed down to prevent wind displacement. Plastic silage covers preserve the quality of the silage, minimize dry matter loss, and minimize leachate production from rainfall infiltration. Studies have shown that it

is more cost-effective to cover open piles than to leave them uncovered.

To effectively reduce leachate volume, the crops should be harvested at the correct dry matter content. Refer to NNTC Environmental Quality Technical Note No. 5, August 1995 for guidance.

To further reduce the volume of leachate, absorbent additives such as alfalfa cubes, chopped dry hay or beet pulp may be used.

For bunk silos that are not covered, evaluate the amount of continuous leachate that flows from the bunker and if significant leachate is transported with the rainfall runoff. If necessary, all runoff shall be collected and stored.

PLANS AND SPECIFICATIONS

Plans shall include engineering drawings and supporting documentation as well as other plans required to manage the system; e.g. a nutrient management plan for proper land application of byproducts.

Plans and specifications for waste treatment facilities shall be prepared in accordance with the criteria of this standard and good engineering practice.

As a minimum, the plans and specifications shall provide the following:

1. Layout and installation details of livestock facilities, waste collection points, waste transfer components, waste treatment and storage facilities.
2. Location of all inflow and discharge pipelines, pipeline materials, diameter and slope.
3. Details of support systems for all components of the treatment facility.
4. Fencing and signage as appropriate for safety purposes.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be developed and reviewed with the owner/operator prior to construction of a waste treatment facility or implementation of a waste treatment process. The O&M plan shall be consistent with the proper operation of all system components and shall contain requirements including but not limited to:

- Recommended loading rates of the waste treatment facility or process for hydraulic and critical pollutant parameters.
- Proper operating procedures for the waste treatment facility or process, including the amount and timing of any chemicals added.
- Operation and maintenance manuals for pumps, blowers, instrumentation and control devices, and other equipment used as components of the waste treatment facility or process.
- Description of the planned startup procedures, normal operation, safety issues, and normal maintenance items. This includes procedures for the planned replacement of components with less than a ten year service life.
- Alternative operation procedures in the event of equipment failure.
- Troubleshooting guide.
- Monitoring and reporting plan designed to demonstrate system performance on an ongoing basis.

O&M Specific to Milkhouse Wastewater Infiltration Areas

- Settling basin and grease traps shall be monitored regularly and periodically cleaned out as required. Proper disposal shall be in a waste storage facility, land application or other acceptable means.
- Shields and other safety features shall be installed and maintained on pumps as per manufacturer.
- Vent pipes for covered tanks shall be kept clear of obstructions.
- Safety precautions shall be exercised prior to entering confined spaces which may contain asphyxiating gases (i.e. self-contained breathing apparatus, proper ventilation, etc.).
- Maintain adequate vegetative cover on the disposal field and adjacent areas.
- Repair of damage to any earthfills, fences, pipes, and other appurtenances.

- Maintain lids and openings to underground structures to ensure year-round access.
- Maintain grates on drains and subsurface drainage systems to ensure they are functional.
- Ensure waste milk is not dumped into the treatment system.
- Strongly consider feeding out the first flush of the system to avoid excess fats from entering the system.

O&M Specific to Silage Leachate Systems

- The protective covers or barriers for open structures shall be maintained to provide human and animal safety.
- Shields and other safety features shall be installed and maintained on pumps as per manufacturer.
- Vent pipes for covered tanks shall be kept clear of obstructions.
- Safety precautions shall be exercised prior to entering confined spaces which may contain asphyxiating gases (i.e. self-contained breathing apparatus, proper ventilation, etc.).
- Grates, screens, or other anti-clogging devices used to exclude solids shall be checked and cleaned as necessary.
- Where storage facilities are emptied by pumping, a detailed pumping plan shall be formulated. Manual or automatic controls shall be maintained in good working order. All pumps, controls, and appurtenances shall be corrosion resistant and periodically maintained or replaced as necessary.
- Land Application shall be in accordance with Vermont NRCS Practice Standard 633, Waste Utilization.
- Land application of silage leachate can be environmentally destructive if the leachate is not properly diluted or pre-treated. Refer to Sections E-3 and E-4 of NNTC Environmental Quality Technical Note No. 5, August 1995 for leachate treatment and land application recommendations.
- Development of an emergency action plan should be considered for waste storage facilities where there is a potential for significant impact from breach or accidental release. The plan shall include site-specific provisions for emergency actions that will minimize these impacts.
- Good recordkeeping is essential for proper O&M and evaluation of the installed facility. Records should be kept of the ensiling dates, percent of dry matter in the silage, volume and frequency of leachate production and removal, and the effects of application rates on vegetative cover.

REFERENCES

- Agricultural Waste Management Field Handbook, Amendment VT-1, Section 651.1004(k)66.
- NRAES-5, Silage and Hay Preservation, 1990.
- MWPS – Agricultural Engineering Digester (AED) 43, Managing and Designing Bunker and Trench Silos, Sept. 1997.
- Vegetated Treatment Systems for Open Lot Runoff, A Collaborative Report, June 2006, Section 6